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History of the Muskingum Slurry Impoundment

American Electric Power's Central Ohio Coal Company – Muskingum Mine, annually produces 1.7 million tons of Meigs Creek #9 coal at its mine located near Cumberland and McConnelsville, Ohio.

The Muskingum Slurry Impoundment was constructed to dispose of both fine and coarse coal refuse. Coal refuse is a byproduct of the coal preparation or washing process, which is designed to remove impurities from the raw coal. The slurry impoundment consists of a large embankment constructed of coarse coal refuse and a large impoundment which is utilized to treat the slurry discharged from the preparation plant. Fine waste material from the slurry settles out in the impoundment and the clear water is returned to the preparation plant for reuse in the coal washing process.

Initial construction of the slurry impoundment began in 1979 as part of a large-scale upgrade of Central Ohio Coal Company's preparation plant. The state of the art upgrade included a fine coal froth cell floatation circuit that required the construction of the slurry impoundment to handle wastes from this process.

The most critical aspect of operating the slurry impoundment has been maintaining adequate fine refuse storage capacity. Additional storage capacity for fine refuse is obtained by building the embankment higher with coarse refuse utilizing upstream construction methods. This technique requires that coarse and fine refuse production rates be carefully monitored to ensure that adequate storage capacity is generated for future use. Due to a projected decrease in production rates it was calculated that only minimal additional fine refuse storage space would be required. This made it possible to reclaim the approximately 20 acres of the impoundment face, while continuing to operate the impoundment by placing coarse refuse on the crest and push outs into the pond area.

Currently the slurry impoundment is approximately 250' in height, covers 120 acres and impounds approximately 3600 acre-feet of sediment and water. It has provided storage for coal wastes generated from 54.6 million clean tons of coal produced by Central Ohio Coal over the last 21 years.

Reclamation of the Slurry Impoundment Downstream Embankment

During 1997 planning began for reclamation of the slurry impoundment's downstream embankment face. The DMR and OEPA reclamation plan required 4' of non-toxic cover material over all exposed refuse. Consideration was given to utilizing FGD material from the AEP Conesville power plant. It was hoped that a combined cover of FGD and non-toxic cover material would be more cost effective than just non-toxic cover material alone. At this time OEPA was still directly involved in the regulation of refuse disposal embankments and a PTI for the beneficial use of FGD as a cover material was required and initially applied for. However due to legislative changes that occurred before construction commenced in May of '99, an OEPA PTI was not required.

Reclamation Accomplishments

1. FGD - Utilization of an Innovative Cover Material to Reclaim Coal Refuse

FGD is a coal combustion by-product of the flue gas desulfurization process. It consists of a calcium sulfite/calcium sulfate filter cake scrubber sludge that is stabilized with fly ash and lime. The filter cake and fly ash are blended at an approximately 1:1 ratio. Lime is added at a rate of 2% to 3%. The FGD material is then stockpiled on a curing pad for three to five days before handling.

FGD is gaining acceptance as an alternative cover material. The FGD material has a demonstrated ability to form an effective barrier to minimize air and water infiltration, acts as an oxygen scavenger to further reduce acid generation and provides an additional source of alkalinity to neutralize acid mine drainage (AMD). In addition to the reductions in AMD treatment costs, the use of FGD reduces the disturbances associated with soil borrowing activities.

Loading, hauling and placement of FGD required careful coordination with the power generating station, transporters and the recipient. The availability of FGD depended on power plant operation. The availability of transportation for back hauling of FGD depended on coal production and shipping of the coal to the Conesville power plant. Due to the cement like properties and high inherent moisture content of the FGD mixture, the material can not be stockpiled for any length of time. Once stabilized, the material must be loaded and transported immediately. On the receiving end it is also important that the FGD be spread and compacted immediately. This required constant construction and maintenance of truck unloading areas and coordination of earth moving equipment to place the FGD.

Covering of the downstream face of the impoundment began in May of 1999. During this time Central Ohio Coal Company was shipping coal to the Conesville Power Plant and FGD was back hauled in the returning coal trucks. The back hauling of FGD in coal trucks that would normally be empty greatly reduced shipping costs. From May '99 to September '99, 75,000 tons of FGD was shipped and spread over 20 acres on the impoundment face to a depth of 30". The downstream face was then covered with 18" of resoiling material that had been previously stockpiled adjacent to the site. The area was seeded during September/October 1999. Despite an extremely dry fall, by the following spring a good ground cover was established.

2. Beneficial Use of a Waste Product

Federally mandated clean coal burning technologies that utilize flu gas desulfurization techniques generate tremendous quantities of scrubber sludge filter cake. This is generally disposed of in on site landfills at a significant cost. Beneficial utilization of this waste as a cover material can result in cost savings for the power plant generating the waste as well as an increased life span for the on site landfill.

3. Water Control and Treatment

Environmentally the benefits of the use of FGD are many. The material has excess lime that can assist in neutralizing existing acid salts on the surface of the refuse. This will immediately improve the short-term water quality of waters arising from a refuse area. The relatively low permeability of the material reduces the quantity of moisture and oxygen that come in contact with pyrites in the refuse. Additionally the significant quantities of calcium sulfite in FGD act as oxygen scavengers. This also limits the amount of oxygen that comes in contact with pyrites and therefore reduces or eliminates the formation of additional AMD. These properties of FGD are of tremendous benefit and greatly reduce or eliminate the long-term generation of AMD and associated treatment liabilities.

Over 8000 feet of rip rap diversions and perimeter ditches around both the reclaimed and active refuse areas help control surface water runoff, diverting it to treatment facilities. OEPA required that approximately 4300 feet of the perimeter ditches be constructed in or lined with impermeable clay. Ultimately upon final reclamation of the slurry impoundment these diversions and ditches will help separate runoff that may require long term treatment from runoff that does not.

Management of groundwater in a coal refuse slurry impoundment is important for the stability of the structure and for the water quality that arises from it. For purposes of stability, the phreatic surface or the level of the water table within the embankment must be kept as low as possible through the use of internal and toe drains. A toe drain approximately 1000 feet long was constructed under the main embankment for this purpose. The toe drain or main under drain is 8 feet to 10 feet in height, 100 feet wide and 1000 feet long. It consists of sized limestone riprap and is totally enveloped in filter fabric and a blanket of sized boiler slag that act as a filter material. Approximately 3800' of smaller diameter downstream internal drains were utilized to control seepage on both downstream abutments and on the face of the embankment at elevations that are above the main under drain. These drains are generally 4 feet x 4 feet with a pea gravel or boiler slag filter material encased in filter fabric that surrounds 4 inch diameter perforated and fabric coated corrugated black plastic drainage pipe. Seepage control in the upstream perimeter dikes surrounding the impoundment was achieved through the use of over 7600 feet of upstream internal drains that utilized construction techniques similar to those used for the downstream internal drains cited above. Over 12,400 feet of drains were installed in the slurry impoundment.

All surface water runoff and groundwater seepage is collected in the two-cell sediment pond located at the toe of the slurry embankment. From there it is pumped to a hydrated lime AMD treatment plant and either discharged or reused in the preparation plant washing process. Sediment is periodically removed from the pond with a MudCat dredge or a small LinkBelt dragline.

Long-term post closure treatment possibilities include the construction of successive alkaline producing drains (SAP drains) in conjunction with a treatment wetland.

American Electric Power
Central Ohio Coal Company

Entry for the 2000 awards Program of the
Ohio Coal Association

Reclamation of the
Muskingum Slurry Impoundment Downstream Embankment

The pictures above and below show the slurry impoundment as it was in the late 1980's. By the time the downstream embankment was reclaimed in the fall of 1999 it had expanded to 20 acres while the entire surface area covered by the embankment and impoundment had grown to 120 acres.

Backhauling of FGD from the Conesville Power Plant in coal trucks that would normally be empty greatly reduced shipping costs. Due to its cement like properties FGD can not be stockpiled. FGD must be spread and compacted immediately to take full advantage of its covering properties.

Above, 30" of FGD and 18" of resoiling material are being placed simultaneously. Below, fall of 1999. The seeding on the lower face is established while the upper face has just been seeded and mulched.

The pictures above and below show the slurry impoundment as it was in the late 1980's. By the time the downstream embankment was reclaimed in the fall of 1999 it had expanded to 20 acres while the entire surface area covered by the embankment and impoundment had grown to 120 acres.